[c2]

[c3]

Claims

- 1.A phosphor blend comprising at least two phosphors selected from the group consisting of (a) Sr 2 P O 7 :Eu 2 + ,Mn 2 + ; (b) (Ca,Sr,Ba) a (PO 4) 3 (F,Cl,OH):Eu 2 + ,Mn 2 wherein a is in a range from about 4.5 to and including 5; (c) 3.5MgO 0.5MgF 2 GeO 2:Mn 4 ; (d) Sr 4 Al 14 O 25 :Eu 2 + ; (e) (Sr,Ba,Ca) 5 (PO 4) 3 (Cl,OH):Eu 2 + ; (f) an europium-activated aluminate phosphor selected from the group consisting of (Ba,Ca,Sr) MgAl 16 O 27 :Eu 2 + , (Ba,Ca,Sr)MgAl 10 O 17 :Eu 2 + , and (Ba,Ca,Sr)Mg 3 Al 14 O 25 :Eu 2 + ; and (g) an europium and manganese co-activated aluminate phosphor selected from the group consisting of (Ba,Ca,Sr) MgAl 16 O 27 :Eu 2 + ,Mn 2 + , and (Ba,Ca,Sr)MgAl 10 O 17 :Eu 2 + ,Mn 2 + , and (Ba,Ca,Sr)Mg 3 Al 14 O 25 :Eu 2 + ,Mn 2 + , and (Ba,Ca,Sr)MgAl 10 O 17 :Eu 4 ,Mn 4 , and (Ba,Ca,Sr)Mg 3 Al 14 O 25 :Eu 2 + ,Mn 2 + ; said phosphor blend being capable of absorbing electromagnetic radiation having wavelengths in a range from about 315 nm to about 480 nm and emitting light having wavelengths in the visible spectrum.
 - 2. The phosphor blend of claim 1, wherein said phosphor blend preferably absorbs electromagnetic radiation substantially in a wavelength range from about 350 nm to about 410 nm.
 - 3. The phosphor blend of claim 1, wherein a is preferably in a range from about 4.7 to and including 5, and more preferably from about 4.9 to and including 5.
- [c4] 4.The phosphor blend of claim 1, wherein said emitted light is white light.
- [c5] 5.The phosphor blend of claim 4, wherein said white light has color coordinates substantially on a black body locus of a CIE chromaticity diagram.
- 6.A phosphor blend comprising a mixture of Sr P O :Eu 2+ ,Mn 2+ and at least one phosphor that is selected from the group consisting of (a) (Ca,Sr,Ba) a (PO 4) 3 (F,Cl,OH):Eu 2+ ,Mn 2+ wherein a is in a range from about 4.5 to and including 5; (b) 3.5MgO 0.5MgF 2+ 2 :Mn 4+ ; (c) Sr 4 Al 14 O 25 :Eu 2+ ; (d) (Sr,Ba,Ca) 5 (PO 4) 3 (Cl,OH):Eu ; (e) an europium activated aluminate phosphor selected from the group consisting of (Ba,Ca,Sr) MgAl 16 O 27 :Eu 2+ , (Ba,Ca,Sr)MgAl 10 O 17 :Eu 2+ , and (Ba,Ca,Sr)Mg Al 14 O 25 :Eu ;

[c9]

- [c7] 7.The phosphor blend of claim 6, wherein said phosphor blend preferably absorbs electromagnetic radiation substantially in a wavelength range from about 350 nm to about 410 nm.
- [c8] 8. The phosphor blend of claim 5, wherein a is preferably in a range from about 4.7 to and including 5, and more preferably from about 4.9 to and including 5.
 - 9.A phosphor blend comprising a mixture of (Ca,Sr,Ba) a (PO 4) 3 (F,Cl,OH):Eu 2+ ,Mn 2+ wherein a is in a range from about 4.5 to and including 5 and at least one phosphor that is selected from the group consisting of (a) Sr 2 P 2 O

 Eu 2+ ,Mn 2+ ; (b) 3.5MgO 0.5MgF 2 GeO 2:Mn 4+ ; (c) Sr 4 Al 14 O 25 :Eu 2+ ; (d) (Sr,Ba,Ca) 5 (PO 4) 3 (Cl,OH):Eu 7+ ; (e) an europium activated aluminate phosphor selected from the group consisting of (Ba,Ca,Sr) 2 MgAl 16 O 2:Eu 2+ , and (Ba,Ca,Sr)Mg 3 Al 14 O 25 :Eu 2+ ; and (f) an europium and manganese co-activated aluminate phosphor selected from the group consisting of (Ba,Ca,Sr) MgAl 16 O 27 :Eu 2+ ,Mn 2+ , (Ba,Ca,Sr)MgAl 10 O 17 :Eu 2+ ,Mn 2+ , and (Ba,Ca,Sr)Mg 3 Al 14 O 25 :Eu 2+ ,Mn 2+ , said phosphor blend being capable of absorbing electromagnetic radiation having wavelengths in a range from about 315 nm to about 480 nm and emitting light having wavelengths in the visible spectrum.
- [c10] 10.The phosphor blend of claim 9, wherein said phosphor blend preferably absorbs electromagnetic radiation substantially in a wavelength range from about 350 nm to about 410 nm.
- [c11] 11. The phosphor blend of claim 9, wherein a is preferably in a range from about 4.7 to and including 5, and more preferably from about 4.9 to and including 5.

- 12.A phosphor blend comprising a mixture of Sr P O :Eu 2+ ,Mn 2+ and (Ca,Sr,Ba)5(PO 4) 3 (F,Cl,OH):Eu 7+ ,Mn 2+ ; wherein a is in a range from about 4.5 to and including 5, and said phosphor blend being capable of absorbing electromagnetic radiation having wavelengths in a range from about 315 nm to about 480 nm and emitting light having wavelengths in the visible spectrum.
- [c13] 13.The phosphor blend of claim 12, wherein said phosphor blend preferably absorbs electromagnetic radiation substantially in a wavelength range from about 350 nm to about 410 nm.
- [c14] 14.The phosphor blend of claim 12, wherein a is preferably in a range from about 4.7 to and including 5, and more preferably from about 4.9 to and including 5.
- [c15] 15.A phosphor blend comprising a mixture of phosphors having formulas 3.5MgO 0.5MgF 2 GeO 2:Mn 4+; Sr 4 Al 4 O 25:Eu 2+; and an europium and manganese co-invented aluminate phosphors selected from the group consisting of (Ba,Ca,Sr) 2 MgAl 16 O 27:Eu 2+, Mn 2+, (Ba,Ca,Sr)MgAl 10 O 25:Eu 2+, Mn 2+, (Ba,Ca,Sr)MgAl 10 O 25:Eu 2+, Mn 2+; said phosphor blend being capable of absorbing electromagnetic radiation having wavelengths in a range from about 315 nm to about 480 nm and emitting light having wavelengths in the visible spectrum.
- [c16] 16. The phosphor blend of claim 15, wherein said phosphor blend preferably absorbs electromagnetic radiation substantially in a wavelength range from about 350 nm to about 410 nm.
- 17.A phosphor blend comprising a mixture of phosphors having formulas

 3.5MgO 0.5MgF 2 GeO 2:Mn 4+; Sr 4 Al 14 O 25:Eu 2+; and an europium and manganese co-activated aluminate phosphors selected from the group

 consisting of (Ba,Ca,Sr) 2 MgAl 16 O 27:Eu 2+,Mn 2+, (Ba,Ca,Sr)MgAl 10 O 25:Eu 2+,Mn 2+, and (Ba,Ca,Sr)Mg 3 Al 14 O 25:Eu 2+,Mn 2+; said phosphor blend being capable of absorbing electromagnetic radiation having wavelengths in a range from about 315 nm to about 480 nm and emitting light

[c20]

[c21]

having wavelengths in the visible spectrum.

- [c18] 18.The phosphor blend of claim 17, wherein said phosphor blend preferably absorbs electromagnetic radiation substantially in a wavelength range from about 350 nm to about 410 nm.
- [c19] 19.A phosphor blend comprising a mixture of phosphors having a formula of 3.5MgO 0.5MgF 2 GeO 2:Mn 4+; (Sr,Ba,Ca) 5 (PO 4) 3 (Cl,OH):Eu 2+; and an europium and manganese co-activated aluminate phosphor selected from the group consisting of (Ba,Ca,Sr) 2 MgAl 16 27 Eu 2+, (Ba,Ca,Sr)MgAl 10 2+; Eu 2+, Mn 2+, and (Ba,Ca,Sr)Mg 3 Al 14 0 25 Eu 2+, Mn 2+; said phosphor blend being capable of absorbing electromagnetic radiation having wavelengths in a range from about 315 nm to about 480 nm and emitting light having wavelengths in the visible spectrum.
 - 20. The phosphor blend of claim 19, wherein said phosphor blend preferably absorbs electromagnetic radiation substantially in a wavelength range from about 350 nm to about 410 nm.
 - 21.A light source comprising: at least one LED that is capable of emitting electromagnetic radiation having wavelengths in a range from near UV to blue; least one phosphor material selected from the group consisting of (a) Sr 2 P 0

 1. Eu 2+ ,Mn 2+ ; (b) (Ca,Sr,Ba) (PO 4) 3 (F,Cl,OH):Eu 2+ ,Mn 2+ wherein a is in a range from about 4.5 to and including 5; (c) 3.5MgO 0.5MgF GeO :Mn 4+ ; (d) Sr 4 I 4 O 5 :Eu 2+ ; (e) (Sr,Ba,Ca) 5 (PO 4) 3 (Cl,OH):Eu ; (f) an europium-activated aluminate phosphor selected from the group consisting of (Ba,Ca,Sr) MgAl 16 O 27 :Eu 2+ ; (Ba,Ca,Sr)MgAl 10 O 17 :Eu 2+ , and (Ba,Ca,Sr)Mg 3 Al 14 O 5 :Eu 2+ ; and (g) an europium and manganese coactivated aluminate phosphor selected from the group consisting of (Ba,Ca,Sr)

MgAl O :Eu 2+, Mn 2+, (Ba,Ca,Sr)MgAl O :Eu 2+, Mn 2+, and (Ba,Ca,Sr)Mg Al O :Eu 2+, Mn 2+, and (h) mixtures thereof; said phosphor material being capable of absorbing said electromagnetic radiation emitted by said LED and emitting light having wavelengths in the visible spectrum.

- [c22] 22.The light source of claim 21, wherein said LED emits electromagnetic radiation in a wavelength from about 315 nm to about 480 nm.
- [c23] 23. The light source of claim 21, wherein a is preferably from about 4.7 to and including 5, and more preferably from about 4.9 to and including 5.
- [c24] 24. The light source of claim 17, wherein said LED preferably emits electromagnetic radiation from about 350 nm to about 410 nm.
- [c25] 25.A light source comprising: at least one LED that is capable of emitting electromagnetic radiation having wavelengths in a range from near UV to blue; and a phosphor material selected from the group consisting of Sr P O :Eu 2+ , Mn 2+ , (Ca,Sr,Ba) a (PO 4) 3 (F,Cl,OH)Eu 2+ , Mn 4 wherein a is in a range from about 4.5 to and including 5, and mixtures thereof; said phosphor being capable of absorbing said electromagnetic radiation emitted by said LED and emitting light having wavelengths in the visible spectrum.
- [c26] 26.The light source of claim 25 wherein a is i preferably from about 4.7 to and including 5, and more preferably from about 4.9 to and including 5.
- [c27] 27. The light source according to claim 20, wherein said phosphor material further comprises a phosphor selected from the group consisting of (a) 3.5 MgO 0.5 MgF GeO : Mn 4+; (b) Sr Al O : Eu 2+; (c) an europium-activated aluminate phosphor selected from the group consisting of (Ba,Ca,Sr) MgAl 16 O : Eu 2+, Mn 2+, (Ba,Ca,Sr) MgAl 10 O 17 : Eu 2+, Mn 2+, and (Ba,Ca,Sr) Mg Al O : Eu 2+, Mn 2+; and (d) an europium and manganese coactivated aluminate phosphor selected from the group consisting of (Ba,Ca,Sr) 2 MgAl 16 O 27 : Eu 2+, Mn 2+, (Ba,Ca,Sr) MgAl 10 O 17 : Eu 2+, Mn 2+, and (Ba,Ca,Sr) MgAl 16 O 27 : Eu 2+, Mn 2+, Mn 2+, and (Ba,Ca,Sr) MgAl 16 O 27 : Eu 2+, Mn 2+,